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VIEWPOINT

Exploring the Significance of Bidirectional Learning for Global Health Education

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INTRODUCTION

The value of bidirectional learning is emphasized both in global health and local community engagement. Conceptualizations of bidirectional learning for global health education are discussed, including implications when it is defined as mutual learning, codevelopment, or academic partnerships. Additionally, we review the relationship of bidirectional learning to different learning theories. Case studies from the field offer examples of how bidirectional learning can occur in the classroom, through academic partnerships, or both. Finally, recommendations are offered to facilitate bidirectional learning in global health education, including in identifying challenges faced by educators in lower-resourced settings who wish to offer bidirectional learning to their students through partnership with higher-resourced academic institutions.

METHODS

Search Strategy and Selection Criteria. The terms *global health* and *international health* were combined and linked with 9 MeSH (medical science search headings) database topics that discuss bidirectional learning in the global health literature. The 9 MeSHs were "bidirectional learning," "mutual learning," "shared learning," "two-way learning," "codevelopment," "international partnerships," "reverse innovation," "disruptive innovation," and "frugal innovation." English-language articles published between January 2000 and June 2016 were included and searches were carried out on PubMed and EBSCO. The search yielded 77 articles eligible for inclusion in this study. In addition to this bibliographic information, we included 4 examples of international partnership developed through one US-based academic health system.

RESULTS

Conceptualizing Bidirectional Learning in Global Health. Bidirectional learning emerges in the global health literature in 2 major ways. First, developed–developing country partnerships are described. These partnerships assume that collaboration among high- and low-income partners is crucial for shared learning and improving global health outcomes.[1] In this context, academic and research partnerships are the primary locus for enhancing bidirectional learning.[2-4] Second, bidirectional learning emerges from mutual learning and sharing of innovations from different parts of the world.[5] The journal *Globalization and Health* initiated an ongoing thematic series, "Reverse Innovation in Global Health Systems: Learning from Low-income

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Table 1. Definitions of Different Types of Innovation That Encourage Bidirectional Learning[7,9]

Term	Year	Definition
Reverse innovation	2010	Develops a low-cost product to disrupt incumbents and creates new markets for growth.[10] In health care, it means diffusion of innovations that low-income countries developed and scaled.
Frugal innovation	2010	Also called "frugal engineering," a type of innovation described as rethinking processes and models, doing more, with less, for many.[11]
Disruptive innovation	2003	A process by which a product or service takes root initially in simple applications at the bottom of a market and then relentlessly moves up market, eventually displacing established competitors. This process builds on the concept of "disruptive technologies," which are typically cheaper, simpler, smaller, and, frequently more convenient to use.[12]
Jugaad	2011	A colloquial Hindi word for grassroots innovation that is an "innovative fix," sometimes of poor quality or of unaccepted standards used for solutions that bend rules.[13]
Open innovation	2003	Combines external and internal ideas as well as internal and external paths to market to advance development of technologies and processes. Open innovation recognizes that good ideas can come from almost anywhere.[14]
Value innovation	2014	Value innovation substitutes the term reverse innovation to emphasize the low-cost quality innovations created in LMICs.[15]
Innovation blowback	2005	A wave of disruptive product and process innovations arising from emerging markets that compete for market share in Europe and the United States and require Western companies to urgently reposition themselves to deal with these offshore challenges.[16]
Bottom of pyramid	2004	The socioeconomic theory that new business opportunities lie in designing and distributing goods and services for poor communities, those at the "bottom of the pyramid."[17]

Countries" (http://www.globalizationandhealth.com/series/reverse_innovations) to gather evidence on the bidirectional flow of knowledge and innovations among low-, middle, and high-income countries.[6] Reverse innovation is a well-established principle in the business world and often is conflated with other popular terms such as *frugal innovation* and *disruptive innovation*[7,8] (Table 1).

In global health, reverse innovation has become a movement describing a more complex and fragmented process with no particular institution in charge and a blurring of lines between supply and demand.[7] Global health innovations are defined as any initiative that takes novel ideas, inventions, or processes and applies them to achieve improved health and greater health equity.[18] Examples of reverse innovations include:

1. Oral rehydration therapy, which is used worldwide for diarrhea and cholera and originally developed in Bangladesh;
2. Directly Observed Treatment, Short Course (DOTS) therapy for tuberculosis developed initially in Uganda; and
3. Policy solutions such as conditional cash transfers initiated in Brazil and Mexico.[19]

Not all embrace the term *reverse innovation*. Nigel Crisp rejects the notion.[19] He sees it as deeply patronizing and ignoring the fact that almost all innovation comes from outside the establishment. Crisp prefers to talk of "global sourcing of innovation," recognizing that different sorts of innovation may come from different settings. Global health is about team work between different people and professions. High-, middle-, and low-income countries should be treated in the same way, as having parts to play, insights to offer, and resources to share. For this reason, Crisp advocates the use of the terms *colearning* and *codevelopment* instead of international development.

We argue that international partnerships have the potential to promote bidirectional learning and that global sourcing of innovations provides tangible examples of bidirectionality for students. Strategies to disseminate and promote bidirectional learning in global health education, including the classroom setting, are explored.

Bidirectional Learning and the Different Ways of Learning. As described in the global health literature, bidirectional learning involves mutual, shared, and 2-way learning. Here bidirectional learning is defined in the context of the current learning theories. Davis and Arend[20] identified 7 different ways of learning without prioritizing any of them:

1. Behavioral learning,
2. Cognitive learning,
3. Learning through inquiry,
4. Learning with mental models,
5. Learning through groups and teams,

Table 2. Seven Ways of Learning That Can Contribute to Bidirectional Learning[20,*]

Intended Learning Outcomes: What Students Learn	Way of Learning: Origins and Theory	Common Methods: What the Teacher Provides
Building Skills **Physical and procedural skills, where accuracy, precision, and efficiency are important**	**Behavioral Learning** Behavioral psychology, operant conditioning	Tasks and Procedures Practice exercises
Acquiring Knowledge **Basic information, concepts, and terminology in a discipline or field of study**	**Cognitive learning** Cognitive psychology, attention, information, processing, memory	Presentation Explanation
Developing critical, creative, and dialogic thinking **Improved thinking and reasoning process**	**Learning Through Inquiry** Logic, critical, and creative thinking theory, classical philosophy	Question-driven inquiries Discussions
Cultivating problem-solving and decision-making abilities **Mental strategies for finding solutions and making choices**	**Learning With Mental Models** Gestalt psychology, problem solving, and decision theory	Problems Case studies Labs Projects
Exploring attitudes, feelings, and perspectives **Awareness of biases, attitudes, and other perspectives, ability to collaborate**	**Learning Through Groups and Teams** Human communication theory, group counseling theory	Group activities Team projects
Practicing professional judgment **Sound judgment and appropriate professional action in complex, context-dependent situations**	**Learning Through Virtual Realities** Psychodrama, sociodrama, gaming theory	Role playing Simulations Dramatic scenarios Games
Reflecting on experience **Self-discovery and personal growth from real-world experience**	**Experiential Learning** Experiential learning, cognitive neuroscience, constructivism	Internships Service learning Study abroad

* Sections in grey considered immediately relevant to bidirectional learning.

6. Learning through virtual realities, and
7. Experiential learning (Table 2).

Bidirectional learning relates most directly to 4 ways of learning, 2 within academic partnerships and 2 within the classroom. Academic partnerships include experiential learning and learning through groups and teams. The classroom includes learning through inquiry and through mental models. Although all ways of learning contribute to bidirectional learning, these 4 ways most directly affect bidirectional learning because sharing different experiences, models, and perspectives underlies bidirectional learning as does experiential learning, team learning, inquiry, and learning through mental models.

Bidirectional Learning in Academic Partnerships. ***Experiential learning.*** Travelling abroad, service learning, and global health internships are the most common methods to promote experiential learning. These are real-world experiences that put students in new and challenging situations. Reflection in action is a way of knowing about what the student is doing in order to learn from personal experience. Experiential learning strengthens intercultural understanding and behaviors necessary in a multicultural and diverse world.

Learning through groups and teams. Group activities and team projects are common learning methods. They promote awareness of attitudes, biases, and other perspectives, in addition to teaching students how to collaborate with others.[20]

Academic Partnership to Facilitate Bidirectional Learning. At the University of Virginia (UVa), the Center for Global Health (CGH) has provided students from all schools with opportunities for experiential global health learning since 2001.[4] More than 500 students have received competitive awards requiring them to develop and undertake, in collaboration with faculty mentors and study site partners, a research or evaluation project. In recent years, a majority of projects have been conducted by

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groups of students. These projects occur primarily at priority partnership sites where UVa faculty have long-term, strong local connections related to research and/or educational programs. Here, we describe 4 priority partnership activities related to bidirectional learning, primarily for UVa-based students. Two are community-based and 2 are hospital-based. Three involve students across disciplines and levels of training, the fourth, with colleagues in Rwanda, focuses on postgraduate medical training. Successful strategies are highlighted and challenges detailed.

South Africa: The Water and Health in Limpopo Collaboration. This is a partnership of the University of Venda (UNIVEN) in Thohoyandou, South Africa, several nearby communities, and the Vhembe District Department of Health with UVa. The partnership, initiated in 2008, focuses on issues prioritized in the South African communities. The 2 primary issues addressed by student–faculty teams have been developing and implementing point-of-use water purification strategies and engaging community health workers to manage chronic disease. More than 100 students from 8 schools at UVa have participated in the fieldwork. In addition to the field experience, the collaboration has facilitated opportunities for bidirectional learning in several additional ways. First, faculty involved with the Water and Health in Limpopo (WHIL) Collaboration developed a course housed within the Department of Public Health Sciences at UVa called Global Health Research Methodologies. The course uses case studies developed within the WHIL Collaboration to highlight research design and community engagement topics that inform students' (both graduate and undergraduate) design of their own local and global community-engaged research projects.

In 2013, the UVa School of Nursing (SON) and School of Medicine (SOM) entered into collaboration with the Vhembe District Health office in Thohoyandou to enhance training of community health workers in noncommunicable diseases. Over the past 3 years, students from UNIVEN and UVa have developed interactive curricula related to supportive management of people living with hypertension and diabetes as well as modules in motivational interviewing (MI). They have developed evaluation tools to assess the educational and community-level effects of their work. The team working on the MI curriculum recognized the need for video training in Tshivenda, one of the languages spoken in the district. These videos were filmed in summer 2016. To facilitate the participation of UVa students in this project, an interprofessional education (IPE) elective, recognized by both the UVa SON and the SOM was developed. Students from UNIVEN also participate in the IPE elective, including in Skype calls before the fieldwork. Unfortunately, challenges remain relative to establishing credit-bearing modules for the UNIVEN students, exchange of credit between the universities, differences in academic calendars and time zones, and adequacy of internet bandwidth for reliable distance communication.

Creating opportunities for more UNIVEN students to participate in WHIL and to receive similar context-specific credit or recognition for it is a priority for the collaboration. Currently, the number of opportunities available is a fraction of those available to US-based students. Endowed support from a private donor has provided funding for some international travel for conferences and for summer stipends for UNIVEN students. Additionally, the WHIL Collaboration has competed for federal funding from the Fogarty International Center (FIC) of the US National Institutes of Health (NIH) to support limited pre and postdoctoral training opportunities for UNIVEN students.

Guatemala: The University of Virginia-Guatemala Initiative. This initiative focuses on partnerships with communities and health care entities in the Lake Atitlán region and around Quetzaltenango in Guatemala. Scores of UVa students from several schools have traveled to the region for individual clinical rotations, as part of interdisciplinary teams, or both. Additionally, community leaders engaged with the University of Virginia-Guatemala Initiative (UVa-GI) have traveled to UVa to speak and to expand the collaboration. In 2014, a full-day forum was held in the UVa Rotunda, a UNESCO world heritage site, and was transmitted in real time to Guatemala, with assistance from the UVa telemedicine group. The Global Health at Home (GHAH) activities embedded within UVa-GI embody important principles of bidirectional learning. GHAH recognizes that many, if not most, students who have had the opportunity to explore global health issues through travel to Guatemala hope to continue their engagement when they return home. GHAH provides a mentored structure within which to sustain engagement. UVa-GI students first travel to Guatemala for language and cultural training with Guatemalan

mentorship from long-term partners of UVa-GI. They also engage in structured clinical observations or community-prioritized research or evaluation projects (eg, slow sand water filtration system implementation and evaluation). After their trip to the Lake Atitlán region, students return home and engage in projects that are designed with leaders in local Latino communities. Projects have included community health worker training; improving emergency room discharge procedures for Spanish-speaking patients; and community mapping. This program makes visible the global–local connections and permits continued engagement with shared health challenges and solution development. Recognition of the diversity of Latino cultures in the Charlottesville, Virginia community, where UVa is located, and attention to recognizing and honoring those differences is one challenge identified by the UVa-GI leadership. Additionally, identification of funding for Charlottesville-based projects often is challenging, even more so than in the Guatemalan context. Finally, as noted with the WHIL Collaboration, identifying opportunities for Guatemalan students, both funding and the logistics of credit exchanges are challenging.

Uganda: The Mbarara University of Science and Technology –University of Virginia (UVa) Research and Training Collaboration (MUVa). This collaboration was launched in 2007 and began with a focus on postgraduate medical training. It has evolved to include undergraduates, graduate students, and faculty from around UVa. Initially, with small grants from the UVa CGH, UVa faculty supported physicians in training at the Mbarara University of Science and Technology (MUST) to complete the research for their masters of medicine (MMed) degree. Subsequently, internal medicine (IM) residents in the UVa Global Health Leadership Residency track were offered the option to complete international health clinical and research experience at MUST. The residents partner with contemporary MUST MMed candidates to plan and conduct research protocols. This has led to 8 first-authored published manuscripts by Ugandan trainees that in many cases were co-authored by UVa residents. The UVa IM residents and MMed trainees also interact during telemedicine-enabled "morning reports" during which each group brings clinical cases to present and discuss. This strategy invites all trainees to interact, not just those who cross the Atlantic.

Since 2014, MUVa expanded to partner with the MUST Institute for Interdisciplinary Training and Research to provide UVa students with diverse opportunities in research and training in other fields such as community health, gender studies, religious studies, and development studies. Over the course of the collaboration, several members of the MUST administration and trainees have come to UVa for visiting professorships or various training programs, and the UVa director of the collaboration was named a visiting professor at MUST. The collaboration has been integral to developing larger programs, including becoming a site for the recently awarded NIH Minority Health and Health Disparities International Research Training program by the NIH Institute for Minority Health and Health Disparities.

Time spent developing trust and true partnerships, telemedicine-enabled communication, and reciprocal visits are key features of this partnership. Although some opportunities have been afforded Ugandan trainees, continued efforts to expand these are essential.

Rwanda: The UVa Global Surgery Initiative in Rwanda. In response to increasing global health interest among surgical residents and the growing need for surgical involvement in global health research and health systems strengthening, the UVa Department of Surgery and CGH partnered with the University of Rwanda/University Teaching Hospital of Kigali to form the UVa Global Surgery Initiative (GSI) in Rwanda in 2012. Like the programs described previously, the GSI developed over time and was nurtured by the strong personal investment of partners on both sides. A key facilitating factor was support from the FIC for 2 surgical trainees to spend 12 months in Rwanda through the Global Health Fellows program. This kind of long-term engagement by trainees is essential for the future of the global health community and can be crucial for developing resilient partnerships. Similar opportunities for trainees from low- and middle-income countries (LMICs) are lacking though it is encouraging that FIC began offering an Emerging Global Leader Award in 2015 which invites applications from junior faculty from LMIC institutions.

Priorities of the GSI include building sustainable architecture and funding mechanisms for bilateral resident clinical rotations, faculty support, travel, and research. Although bidirectionality is at the core of this important academic partnership, it also is the source of its greatest challenges—visitors from LMICs are not currently allowed clinical responsibilities during rotations at UVa, and

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securing reliable housing for visiting UVa residents in Rwanda has remained an obstacle. In addition to bidirectional exchange of faculty and trainees, a quarterly teleconference during which trainees from both sites present and discuss cases was established in 2014 and is ongoing, and several UVa residents have engaged in research in Rwanda, often working directly with Rwandan faculty and trainees to develop and carry out new research protocols.

The UVa GSI is one of many partnerships that have sprung up across the globe that pair academic institutions in high-income countries (HICs) with partner institutions in LMICs. Components of these programs vary, but common themes include clinical experience for trainees, cultural understanding of surgical practice in a differently resourced setting, and clinical research.[21,22] Despite the fact that most programs have a stated aim of increasing understanding of cultural differences between practice settings of each included site, only a subset of programs have a bidirectional exchange component.[23]

Choosing the right setting is imperative to the success of a bilateral surgical training program. Both sites must be engaged and invested in the exchange process. They must both be willing to make allowances and sacrifices for the betterment of the bilateral program. For example, it may be reasonable for the LMIC site to offer housing with a local faculty member or trainee, while offering support for educational or training materials can be supplied by the HIC partner. The programs must work to align their expectations and priorities, which should include shared areas of academic interest, cooperative arrangements for advancing surgical education and research training, and exchange of both personnel and academic materials.

The future of global surgery electives depends on removing barriers to achieving equal benefits for trainees from both HICs and LMICs. Gregorian et al. outlined challenges to bidirectionality, expanding on previous work by Umoren and colleagues that highlighted the need for hands-on electives for LMIC learners visiting their partner institution.[24,25] Challenges specific to surgery likely include a limited number and variety of cases and logistical problems with licensing and access to the operating room for LMIC trainees visiting HICs. The potential benefits to an international surgery elective include fostering collaborative partnerships and mentorship relationships, engaging in bilateral academic surgical research, developing educational initiatives, and using new technologies related to mobile health and telemedicine.

Bidirectional Learning in the Classroom. Most global health educators value bidirectional learning.[26] Experiential learning and working through groups and teams are ways bidirectional learning can be encouraged in international academic partnerships, as described in the 4 case studies. We advocate for identifying teaching strategies that make students aware of bidirectional learning in the classroom as well. We expect students to be more open to and engaged in bidirectional learning when going to the field if they previously engaged with it in the classroom. Learning through inquiry and mental models can prepare students to recognize bidirectional learning and later transfer that knowledge to the real world. Additional opportunities to adapt these strategies in settings that include both HIC and LMIC students or that provide them in LMIC settings are needed. Resources available online to facilitate this transfer are highlighted.

Learning Through Inquiry. Educators want their students to be able to think. Inquiry is a way of learning that facilitates thinking by asking questions.[20] Three main types of thinking that are developed by students through inquiry are critical, thinking, and dialogic thinking.[20] Critical thinking often is used to build an argument or in criticizing the arguments of others by analyzing the way evidence is used to support a point of view. Creative thinking often breaks the rules and can result in creative products, services, inventions, or new processes. Dialogic thinking involves appreciating different points of view. Discussions and question-driven inquiries are common methods of learning though inquiry.

Learning With Mental Models. Mental models are used for problem solving and decision making to solve hypothetical (eg, math exercise) or real-world problems.[20] Mental models allow students to set up hypothetical situations, make predictions about outcomes, and mentally run the model to test those predictions. Problems, case studies, projects, and labs are common methods to cultivate problem-solving and decision-making abilities. Unlike case studies and projects, in which students are often given the mental models first, problem-based learning is a teaching strategy that also requires students to select, develop, and apply appropriate mental models.

Strategies That Encourage Bidirectional Learning in the Classroom. Bidirectional learning starts in the classroom. We suggest that by initially "thinking about it" and "eliciting mental models" related to

bidirectional learning, students have the potential to transfer this knowledge to everyday global health practice at a later date.[20] Four examples illustrate bidirectional learning while teaching global health content: global health discussion/debates; frugal innovation exercises; global health challenges, and case studies in global health delivery.

Global Health Discussion/Debates. Discussion and debates stimulate students to learn about critical thinking and different points of view at the same time (dialogic thinking).[20] Learning different points of view is a first step in opening up students to others' perspectives. When selecting a global health topic for small-group discussion, we ask that students discuss and consider the same theme from different perspectives. Debates are powerful exercises to enhance dialogic thinking. For example, in a debate focused on globalization and health, the "pro" group will debate that "globalization is affecting the broad determinants of health in positive ways," whereas the "con" group takes the opposite position. Students learn to add different perspectives and points of view to their thinking.

Frugal Innovation Exercise. When bidirectional learning is mentioned in the literature, it is more often taught in a rhetorical, value-laden manner rather than with concrete examples.[27-29] An exercise highlighting "frugal innovation" can teach bidirectional learning to students more effectively by exploring concrete examples of global sourcing of innovation. Navi Radjou described frugal innovation as *jugaad*, which in Hindi means an improvised solution born from ingenuity and cleverness. There are 6 principles to *jugaad* innovation: seek opportunity in adversity, do more with less, think and act flexibly, keep it simple, include the margin, and follow your heart.[30] Examples of frugal innovation also serve as "mental models" of the occurrence of bidirectional learning.

The Lancet's Technologies for Global Health Commission[18] provided a series of examples of frugal technologies for global health that were developed in low-resource regions but that could be adapted and adopted by HICs. Some health technologies are not artifacts (products), but are instead less tangible innovations, such as more efficient scheduling of surgical rooms in India (process), which allows for more procedures in the same room on the same day. Breast milk banks can be considered another example of frugal innovation (process and product). Since 1985, Brazil has served as a model in creating the largest network of breast milk donors.

One easy, yet effective way to emphasize bidirectional learning is to ask students to investigate a frugal innovation. To this end, Redko created a class assignment where students are asked to select one frugal technology and/or frugal innovation (process/product). The students summarize its current impacts and consequences (intended and/or unintended). They may describe what aspects of a frugal innovation are working, which are not working, where it is being implemented, why, and at what cost. This classroom exercise could be extended to a multidisciplinary team-based project in which students have the opportunity to propose a frugal technology solution for the real world. (Contact first author for exercise handouts.)

Global Health Challenges. In 2009, Emory University introduced The Emory Global Health Case Competitions. These competitions provide graduate and undergraduate students from multiple disciplines the opportunity to come together to develop innovative solutions for 21st-century global health issues. Teams from universities around the world compete for the best solution for a global health case study or problem. Teams are given approximately 5 days to prepare their response. This exercise is both problem-based learning and learning through groups and teams (http://globalhealth.emory.edu/what/student_programs/case_competitions/index.html).

It is possible to adapt the global health challenge model to both classroom and online environments. Redko[31] described a graduate course in which individuals working in Somaliland challenged MPH students in the United States to explore the problem of high maternal mortality in Somaliland. This resulted in a systematic and documented review of the problem recommending mobile health interventions.

Redko developed a general education course for undergraduate students structured with the online global health challenge. Online courses offer greater diversity within the student pool, potentially bringing in students from more than one country. When transposed to online, small groups of students have a specific global health challenge to work through off-line and then receive online feedback from instructors. Students present online through videos, power points, real-time discussions, and other techniques. Two-way learning is emphasized when students learn about the projects and solutions developed by the other groups at the conclusion of the activity (see also http://www.deltaomega.org/innovativeCurriculumAward.cfm).

The global health challenge can also be adapted to raise awareness university-wide about global

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health issues. At UVa, a Global Health Case Competition is held annually. The winning team travels to the international competition at Emory. For the past 3 years, cases have been developed in collaboration with community and international partners, which has allowed our partners to crowd source solutions to a community-prioritized challenge and then to choose from proposed solutions. Additionally, students have become involved in implementation of parts of the selected solutions in collaboration with the partner site. This model has created opportunities on campus for involvement and sensitization to global health challenges for the student leadership team that creates the case, for the students who participate in the week-long competition, and for the winning team.

Case Studies in Global Health Delivery. The Harvard University Global Health Delivery Project has developed more than 30 teaching case studies with accompanying teaching notes (http://www.globalhealthdelivery.org/) At UVa, the directors of the Global Health Leadership Track, a program that includes postgraduate medical trainees from 8 clinical departments, have incorporated these cases into a 2-week intensive graduate course, Global Health Policy and Practice (see also http://www.globalhealthdelivery.org/our-work/case-collection). The students spend half of each of 10 full class days working through a case study. Each case study examines programmatic, organizational, and policy-related decisions that global health leaders encounter within and across health care delivery systems in resource-limited settings. Each case begins with a brief vignette that describes the protagonists, the context, and the pressing challenge. It also provides relevant information related to the historical, political, and economic background followed by a description of the health system and health issues affecting the population. All case studies define global health delivery through a framework that emphasizes how these programs create value for the people they serve. The cases are based on true situations and are designed to be discussed in 90-minute classroom sessions.

DISCUSSION

Facilitating Bidirectional Learning in Global Health Education. This paper identifies strategies that promote bidirectional learning in global health education. Academic partnerships are one way to enhance bidirectional learning, particularly through experiential learning for students from HICs because more resources are available to them for travel to partner sites in LMICs. Academic partnerships provide a framework in which students can become a part of multinational faculty- and community-member collaborations for research, evaluation, capacity building, or community engagement. Within these partnerships, students can observe bidirectional learning that is modeled by faculty partners, and they should also be expected to engage in it themselves. Development and maintenance of these partnerships require institutions to invest time, people, and money. The returns on these investments include outstanding experiential learning opportunities, innovative research and discovery, and internationalization. However, it is essential to attend to equitable distribution of opportunities at all levels and settings. Some US-based federal programs exist to support students and faculty from LMICs, but the demand by students from LMICs and HICs exceeds the available support. Universities should consider targeted investment in developing longitudinal, reciprocal partnerships similar to those described here with additional attention to strategies that overcome persistent opportunity inequities.

Teaching strategies and tools like those described should be collected into a repository of practical and concrete examples that promote and demystify bidirectional learning. Use of this repository by those involved in global health education offers students the chance to understand the value of and strategies for engaging across cultures and with the global health challenges of interest. We expect that students will participate more effectively in bidirectional learning in the field if they have had previous exposure and practical experiences in the classroom setting. This repository should be shared with colleagues in LMICs and opportunities provided to explore and implement adaptations into learning environments in LMICs. These curricular tools could help to enhance learning opportunities for students in LMICs as well, especially if online strategies for collaboration are included.

True education in global health requires emphasis and embodiment of principles of reciprocity and respect across what can appear to be vast divides. Concepts of bidirectional learning support these practices especially when rooted in partnerships and facilitated by the growing toolbox of global health teaching strategies presented. Continued attention to the pursuit of more equitable availability of opportunities for learners from LMICs is also essential.

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